

Jack Moriarty, Environmental Manager  
439 SPTG/CEV  
Westover Air Reserve Base  
250 Patriot Ave, Suite 1  
Chicopee, MA 01022

December 2, 1998

Chicopee Wastewater Treatment Facility  
Chicopee, MA 01022

Attention: Laurie Goff or Tom Hamel

To Whom It May Concern:

**Subject: Disposition of Waste from WARB Deicing Operations**

The purpose of this letter is to request your written approval for discharge of deicing operations waste to your treatment facility. At Westover Air Reserve Base (WARB), aircraft may be required to fly sorties during cold weather and precipitation events. We are currently employing Best Management Practices and Pollution Prevention Procedures in accordance with Air Force Policy in an effort to minimize generation of deicing wastes and their potential environmental impact. The primary component of deicing fluid is propylene glycol. The fluid is diluted with water prior to application to the airframe. Modified sweeper trucks are used to collect deicing wastes which are stored in an underground storage tank until disposition. During the deicing season, WARB expects to collect approximately 12,000 gallons of waste (5-15% propylene glycol). Therefore, the anticipated organic loading for this waste would be approximately 8,000 to 24,000 mg/L BOD.

Please feel free to contact me with any further questions or concerns.

Thank you for your time and consideration,

Jack Moriarty  
Environmental Manager  
Westover Air Reserve Base

20000712 013

THIS COPIED INFORMATION

## REPORT DOCUMENTATION PAGE

AFRL-SR-BL-TR-00-

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Project (0704-0182).

and reviewing  
information

1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE June 2000	3. REPORT TYPE AND DATES COVERED FINAL TECHNICAL REPORT 1 Mar 97 - 31 Aug 99
4. TITLE AND SUBTITLE MODELING THE FATE OF MILITARY AIRCRAFT ANTI-DEICING AGENTS THROUGH ENVIRONMENTAL TRANSPORT			5. FUNDING NUMBERS F49620-97-1-0176  69120C 6624/00
6. AUTHOR(S) DOBROSLAV ZNIDARCIC			
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) UNIV OF COLORADO DEPT OF CIVIL, ENVIRONMENTAL, AND ARCHITECTURAL ENGIN BOULDER, CO 80309-0428			8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AIR FORCE OFFICE OF SCIENTIFIC RESEARCH 801 N. RANDOLPH STREET, ROOM 732 ARLINGTON, VA 22203-1977			10. SPONSORING/MONITORING AGENCY REPORT NUMBER
11. SUPPLEMENTARY NOTES			
12a. DISTRIBUTION AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE, DISTRIBUTION IS UNLIMITED			12b. DISTRIBUTION CODE
13. ABSTRACT (Maximum 200 words) Identified all potential deicing locations including: Pad 23, Pad 05, Pad 19, North Ramp, VIP, East Ramp at E-8, and the fuel cell for tail deicing. Discussed prioritization. Deicing is generally done at Pads 23 and 05. Pad 19 was a one time occurrence due to a Special Operation that overwhelmed the parking capacity and is unlikely to ever be used again for deicing. If deicing occurs at the East Ramp, the North Ramp, the VIP or the fuel cell, the storm drains are covered with mats and the ADF waste is collected with sweeper trucks and deposited in an 8000 gallon dedicated collection tank in the pull-through hangar.			
14. SUBJECT TERMS			15. NUMBER OF PAGES 41
			16. PRICE CODE
17. SECURITY CLASSIFICATION OF REPORT U	18. SECURITY CLASSIFICATION OF THIS PAGE U	19. SECURITY CLASSIFICATION OF ABSTRACT U	20. LIMITATION OF ABSTRACT

LEADS QUALITY INSPECTED 4

Standard Form 298 (Rev. 2-89) (EG)  
Prescribed by ANSI Std. Z39.18  
Designed using Perform Pro, WHS/DIOR, Oct 94

## **Trip Report**

Westover Air Reserve Base

26 April to 27 April 1999

Prepared By: Cyndee L. Gruden

### **Memorandum For**

439 SPTG/CE

Westover Air Reserve Base

250 Patriot Ave, Suite 1

Chicopee, MA 01022

**From:** University of Colorado at Boulder  
Department of Civil and Environmental Engineering  
Campus Box 428  
Boulder, CO 80309

**Subject:** Trip Report of Site Visit to Westover Air Reserve Base to provide assistance with evaluation and improvement of existing deicing practices at Westover Air Reserve Base (WARB).

### **Trip Objectives:**

- To gather data from deicing events during Winter 1998-1999.
- To assist Science and Engineering Associates, Inc. (SEA) in preparing the deicing chapter of the Stormwater Pollution Prevention Plan (SWP3) for WARB.
- To provide SEA with the draft deicing chapter of the SWP3 as prepared by the University of Colorado at Boulder (CU-B).
- To visit the Chicopee Wastewater Treatment Facility to discuss the written agreement for disposal of deicing waste as submitted by WARB.
- To acquire the Supervisor's Handbook from AGS outlining deicing procedures to be followed in the field for coordination with the SWP3.
- To determine the status of the NPDES permit.

- To discuss the information gathered by Jack Moriarty regarding deicing practices at Westover Municipal Airport.
- To review the draft sampling plan as submitted by CU-Boulder in October of 1998.
- To complete the scope of work provided by CU-Boulder to WARB regarding deicing practices.

#### **People Contacted:**

Jack Moriarty - 439 SGPT/CEV (x-2434)

Joe DiMartino - 439 SGPT/LGS (x-?)

Joe Strouse - 439 SGPT/LGS

Laurie Szlachetka – IPP Coordinator, City of Chicopee POTW (594-3585)

William Archambeau - 439 SGPT/BE (x-2663)

Bob Horrigan – Roads and Grounds (x-?)

Tina Blackmore - SEA, Inc.

John Schott - SEA, Inc.

#### **Trip Overview:**

##### **Miscellaneous Items:**

- There is no new information regarding the status of WARB's NPDES permit according to Jack Moriarty.
- Mike Bolton from Westover Municipal Airport indicated to Jack Moriarty that 3000 gallons of %40 ADF were used in one deicing event this past winter. The deicing location for the Commercial side of the airfield is adjacent to Hangar 15 off Sierra Taxiway.

##### **Deicing Operations at WARB:**

Gallons of ADF used each season according to Judy Roman in Supply:

1996-1997	1997-1998	1998-1999
28,898 gallons	10,844 gallons	11,491 gallons

- According to Joe Dimartino, there were three big deicing operations using about 3,000 gallons at 3 different locations including Pad 05, Pad 23 and E-13 this deicing season. At Pad 05, deicing operations occurred in the middle of the pad in order to avoid discharge to a nearby storm drain. The majority of the ADF waste dispersed to the snow or evaporated on the pad.
- In the past, E-8 was noted as the preferred deicing location on the East Ramp. However, deicing may occur at E-5, E-6 or E-13 as well depending upon location of the aircraft. In any case, gel mats are used to plug the storm drains and a sweeper truck vacuums up the ADF waste to be discharged to an underground storage tank (UST) for later discharge to the POTW.
- LGS currently is responsible for training their own people including those responsible for deicing TA aircraft. All procedures followed are outlined in the "Supervisor's Handbook". The "Supervisor's Handbook" was not available on the day of our meeting with LGS. Again, Joe DiMartino agreed to ask Mike Majors for a copy of the document for our use. I recommended to Tina Blackmore of SEA that she coordinate the handbook with the updated SWP3.
- Deicing a C-5 requires 3 to 4 deicing trucks including 2 people per truck plus at least one supervisor.

#### Roads and Grounds

- RIDs system is still not repaired. The current system will most likely be abandoned as it is anticipated that paving over the existing sensors will occur this summer.
- During previous visits to WARB, it was determined that the RIDs system is an asset to WARB. It would be particularly helpful to have this system operational for the transition to anti-icing chemicals such as potassium acetate. These chemicals are most effective when applied at the early stages of a deicing event. Determining the change in runway conditions is facilitated with a RIDs system.
- Roads and Grounds at WARB currently relies on urea and plows for snow removal on runways. In winter 98-99, 28.5 tons of urea was applied for runway deicing. The short-term goal is to eliminate urea due to its high pollutant load.

- The Grounds and Road crew at WARB is in the process of switching from using urea to potassium acetate (E-36) for anti-icing in accordance with Airforce policy. According to Bob Horrigan, the E-36 applicators were not working adequately this winter. Bob Horrigan from Roads and Grounds estimated that he would use 6,000 gallons of potassium acetate per application.

#### Discharge of ADF Waste to POTW:

- Jack Moriarty confirmed the need for a letter on file from the Wastewater Treatment Facility outlining an agreement regarding discharge of ADF waste to the facility per Air Force requirements. CU-B assisted WARB in writing this required document.
- A Baseline Monitoring Report (BMR) of the ADF waste stored in the UST for eventual discharge to the POTW was completed. The POTW needs to review the results of the BMR to develop a permit for long term discharge of the ADF waste. The permit will include an appropriate metering rate and cost per gallon of ADF waste received.
- Prior to analysis, WARB was allowed to discharge ADF waste at a rate of 5 gpm to not exceed a maximum of 15000 lbs/day of BOD at the POTW headworks.
- The Chicopee POTW is currently receiving approximately 10 million gallons of waste per day at 150 mg/l BOD or <13,000 lbs/day of BOD. This is well below the design capacity of the facility, which was originally designed to treat brewery waste. This facility was designed to handle up to 15 million gallons per day or 15,000 lbs/day BOD.
- The IPP Coordinator, Laurie Szlachetka did not see any problem with current or future discharge of ADF waste to the POTW. A discharge did occur this winter to the POTW and no unusual treatment problems were observed.

#### SWP3 Update:

- During my visit at WARB, Tina Blackmore and John Schott of SEA, Inc. were on site working on an update to the SWP3 for WARB.
- I provided SEA with a copy of my previous trip reports outlining various deicing procedures and documents.

- I also provided SEA with an edited copy of the draft of the deicing section of the SWP3 as submitted to Jack Moriarty in May of 1998. We discussed comments made by Jack Moriarty for improvement of the document.
- We evaluated the condition of the outfalls along the boundary of WARB with Bob Horrigan. No evidence of deicing runoff was found. John Schott who had prepared the SWP3 for WARB in the past noted a marked improvement in outfall conditions. In previous visits, he could see a discoloration and could smell a pungent odor at the outfalls.

**Scope of Work provided by CU-B:**

- CU-B reviewed all BMPs/PPPs outlined in the Interim Guidance. CU-B documented the effectiveness of those BMPs/PPPs currently being used and evaluated any BMPs/PPPs not utilized at WARB for their applicability to WARB's operations (5/98).
- CU-B assisted WARB in drafting a letter to the Chicopee Wastewater Treatment Facility regarding discharge of ADF waste as required by AF policy (12/98).
- CU-B provided a *draft* chapter for the SWP3 to SEA, Inc. and to WARB regarding deicing procedures at WARB (4/99 and 10/98, respectively).
- CU-B reviewed the Groundwater Sampling Results from the Wetlands Assessment (dtd 16 April 98) and provided guidance for the development of a sampling plan to be implemented at deicing locations to investigate the potential impact of deicing practices on those areas (10/98).
- CU-B prepared and submitted a Literature Review of Treatability of ADF Waste (10/98).
- CU-B prepared an attachment to the Literature Review regarding the International Symposium entitled "Deicing and Dustbinding - Risk to Aquifers" held in Helsinki, Finland on October 14-16, 1998 (Appendix D) (12/98).

**Action item to be completed:**

- CU-B agreed to provide WARB with assistance in developing a request for proposal (RFP) for an investigation into the fate of ADF waste during deicing operations at Pads 0-5 and 2-3.





## **Trip Report**

### **Westover Air Reserve Base**

**4 May to 5 May 1998**

Prepared by: Cyndee Gruden

cc: Jack Moriarty, Maj Jeff Cornell, Mark Hernandez

#### **Background:**

The University of Colorado at Boulder (UC-B) has been employed by the AFRC to provide assistance with evaluation and improvement of existing deicing practices at Westover Air Reserve Base (WARB) and to provide information on potential aircraft deicing fluid (ADF) waste treatment alternatives. (This report is only intended to provide an outline of the topics covered during the visit. Complete details of the information collected during this visit will be included in the final report.)

#### **Guidance Documents:**

- a. USAF/CEV Interim Guidance dated 5 Dec 96 "Pollution Prevention and Best Management Practices for Aircraft and Airfield Deicing/Anti-icing Operations"
- b. AFRC/CEV letter dated 27 June 97 "Guidance Package for Anti-icing and Deicing of Planes, Aprons, and Runways"

#### **Trip Objectives:**

- Define the scope of work to be completed by CU-Boulder for 439 SPTG/CEV Westover Air Reserve Base (WARB).
- Obtain relevant details of deicing operations at WARB.
- Review of Best Management Practices (BMPs)/Pollution Prevention Procedures (PPPs) outlined in USAF/CEV Interim Guidance (dated 5 Dec 96).

- Gather information required for evaluation of on-site and off-site treatment alternatives for aircraft deicing fluid (ADF) waste.
- Review Wetlands Assessment prepared by O'Reilly, Talbot and Okun Associates, Inc. (dtd 16 April 98).

#### People Contacted:

Jack Moriarty – 439 SGPT/CEV (x-2434)  
Gina Rossi – 439 SGPT/CEV (x-2484)  
Michael Major - 439 AGS/LGG (x-2370)  
Alan Rogers 439- AGS/LGG (x-2877) DSN 589  
Capt. David Post - 439 AGS/LGG (x-3311)  
Daniel Carr – 439AGS/LGLS (Scheduling (LG)) (x-3042)  
Les Squire – 439 AGS/MAM (x-2158)  
Susan Stell – HQ AFRES/CEVCM (DSN 497-1078)  
Bob Rys – Airfield Manager (x-2944)  
Mike Bolton – Civilian Airfield Manager (COMM 593-5543)

#### Trip Overview:

- Donna  
use this
- Identified all potential deicing locations including: Pad 23, Pad 05, Pad 19, North Ramp, VIP, East Ramp at E-8, and the fuel cell for tail deicing. Discussed prioritization. Deicing is generally done at Pads 23 and 05. Pad 19 was a one time occurrence due to a Special Operation that overwhelmed the parking capacity and is unlikely to ever be used again for deicing. If deicing occurs at the East Ramp, the North Ramp, the VIP or the fuel cell, the storm drains are covered with mats and the ADF waste is collected with sweeper trucks and deposited in an 8000 gallon dedicated collection tank in the pull-through hangar. Because so little was collected last winter, the disposition of large amounts of collected ADF wastes is unlikely (*i.e.* release to sewer or collection by a contractor?). At Pads 23, 05, and 19, overland flow may occur. This overland flow can reach storm drains, or it will disperse into

the subsurface depending on aircraft placement and deicing fluid volumes. In December of 1997, a large deicing event occurred at Pad 23. However, overland flow was not shown to reach the storm drains. The majority of deicing waste evaporated on the pad or seeped through the cracks of the pad surface.

- Reviewed BMPs/PPPs outlined in the USAF/CEV Interim Guidance (dtd 5 Dec 96) to determine which procedures are currently being employed for C-5 deicing (Capt D.Post, M. Major, A. Rogers and D. Carr). Refer to Attachment 1.
- Reviewed deicing protocol for transient aircraft (TA) to determine if BMPs/PPPs are being followed (or are applicable) per USAF/CEV Interim Guidance (dtd 5 Dec 96). Refer to Attachment 1. Received logs of TA deicing events from 97/98 including date, volume of propylene glycol, aircraft type, and location of deicing (Les Squire).
- Discussed use of sweeper trucks and storm drain mats for ADF waste collection. A new sweeper truck has been requested for fiscal year '99 by 439 SPTG/CEV to be used for deicing practices. In addition, a sweeper truck currently in the LGT fleet is being retrofitted to support deicing operations.
- Visited deicing locations used by TA in 97/98 including Pad 23, Pad 05, North Ramp and VIP.
- Discussed status of the National Pollution Discharge Elimination System (NPDES) permit with Gina Rossi and Jack Moriarty. George Papadopolous of EPA Region 1 is the point of contact. Discussed possibility of a multi-sector permit in lieu of existing permits at outfalls 001 and 002.
- Reviewed case files, deicing technology files, and WARB deicing reports provided by Jack Moriarty.
- Discussed commercial deicing practices at WARB with Jack Moriarty. Left message with Mike Bolton.
- Discussed existing Runway Ice Detection System (RIDS) system with Bob Rys. He does consider this system an asset and thinks repairing the RIDS would be beneficial.
- Received a copy of the Wetlands Assessment prepared by O'Reilly, Talbot and Okun Associates, Inc.
- Received a copy of the Storm Water Pollution Prevention Plan (SWP3) and discussed it with Gina Rossi.

- Reviewed ADF waste disposal methods currently in use and those options under consideration with Jack Moriarty and Gina Rossi.
- Received a copy of the recent research proposal submitted by Mike Switzenbaum at U Mass – Amherst.
- Copied pertinent site plans and literature as provided by WARB.
- Determined scope of work to be provided by CU-Boulder for WARB.

**Scope of work to be provided by CU-Boulder:**

- CU-B will review all BMPs/PPPs outlined in the Interim Guidance. CU-B will document and evaluate the effectiveness of those BMPs/PPPs currently being used and any other relevant methods being employed at WARB. Further, CU-B will evaluate any BMPs/PPPs not utilized at WARB for their applicability to WARB's operations.
- CU-B will provide a draft version of a chapter designed to be included in the SWP3 regarding deicing procedures to be carried out at WARB.
- CU-B will evaluate potential on-site and off-site ADF waste treatment alternatives including recycling, discharge to POTW, existing wetlands, constructed wetlands, anaerobic treatment, aerobic treatment.
- CU-B will review the Groundwater Sampling Results from the Wetlands Assessment (dtd 16 April 98) and will provide guidance for the development of a sampling plan at Pads 23 and 05 to investigate the potential impact of deicing practices on those areas.
- All documents are to be completed by May 1999. Draft copies of documents are to be presented before the end of the fiscal year for review.
- Another site visit will be scheduled for October 1998 to review the interim documents and collect any additional information from WARB.

**Some action items to be completed for the interim report (due Oct 98):**

- Estimated costs for disposal of ADF waste to the local POTW (POC: Gruden).
- Details on Commercial Airline Operations at WARB (Mike Bolton 413-593-5543 POC: Gruden).
- First few pages of WARB phone directory including chain of command (POC: Moriarty).
- Send specifications of the existing glycol distillation system (POC: Moriarty).
- Provide site characterization from Landfill B Report prepared by Parsons Engineering (John Latrosio – Syracuse: Doug Downing – Denver. POC: Moriarty)
- Provide Capt. Post with three (3) copies of the IAW Interim Guidance (dtd Dec 96) (POC: Gruden).
- Send logs of C-5 deicing events including volumes of ADF used, dates, and deicing location (POC: Moriarty).

## Attachment 1

WARB Deicing Procedures being carried out in accordance with  
BMPs/PPPs in the USAF/CEV Interim Guidance (dtd 5 Dec 96)

BMPs/PPPs	439 AGS: C-5s Aircraft Generation Squadron	TAs Transient Alert
Prioritization	439 OG/DO – Ops group makes decisions about flying based on weather. Schedule is reduced 10-15% during deicing season.	Delayed take-offs are frequent
Parking	C-5s are stored in the pull-through or fuel cell if weather reports indicate a potential deicing event. If time allows, planes are deiced with hangar heating system. Aircraft parked in the sun.	TAs parked on the N Ramp. TA C-5s are handled by AGS. Aircraft parked in the sun to facilitate melting.
Mechanical Removal	Shovels and squeegees are used. Ropes are not feasible or effective for C-5 deicing. Manpower is limited. Provide manpower to TA also. All standard practices are watched by QA.	Shovels and squeegees used. Additional manpower would be helpful.
Containment	All deicing performed in the vicinity of a storm drain is collected with a sweeper truck. The truck is emptied into an 8,000 gallon underground storage tank in the hangar.	If deicing occurs on N Ramp, ADF waste is collected with mats and sweeper truck.

WARB Trip Report  
May 1998

Anti-Icing	No Type II fluid used at WARB.	Same
Deice to Aircraft Washracks	Washracks located in the hangar only. Snowmelt is diverted to the washrack when heating system alone is used for deicing.	N/A
Recycling	Recycling system is not in operation. However, attempts have been made to find a contractor to collect and recycle the waste. WARB does not produce enough waste to utilize this BMP.	Same
Training/Supervision	AGS personnel are aware of, and are trained using the information contained in the Interim Guidance.	Same
RIDs	Not currently operating correctly.	Same
Data Collection/ Record Keeping	Logs of deicing events kept, but locations and tail numbers need to be added to the logs. Manpower logs are also kept.	Detailed logs kept including date, aircraft type, gallons of water and gallons of ADF used.
Pavement Deicers	Urea used occasionally in isolated spots.	Same

N/A = not applicable

Same = same information as provided for 439 AGS.

## **Trip Report**

Westover Air Reserve Base

6 October 1998

Prepared By: Cyndee L. Gruden

**Memorandum For**

439 SPTG/CE

Westover Air Reserve Base

250 Patriot Ave, Suite 1

Chicopee, MA 01022

**From:** University of Colorado at Boulder  
Department of Civil and Environmental Engineering  
Campus Box 428  
Boulder, CO 80309

**Subject:** Trip Report of Site Visit to Westover Air Reserve Base to provide assistance with evaluation and improvement of existing deicing practices at Westover Air Reserve Base (WARB).

**Trip Objectives:**

- Participate in Stormwater Pollution Prevention Plan (SWP3) meeting to obtain relevant details regarding deicing operations at WARB.
- Present and review the draft of the deicing section of the SWP3 as prepared by the University of Colorado at Boulder (CU-B).
- View a short film distributed by AFCEE and AFIT outlining BMPs/PPPs for deicing practices.
- Present and discuss the Literature Review of Alternative Treatment Methods for ADF Waste prepared by CU-B for WARB regarding deicing waste treatment alternatives.
- Present and review the Draft Sampling Plan Guidelines submitted by CU-B in reference to the Wetlands Assessment prepared by O'Reilly, Talbot and Okun



Associates, Inc. (dtd 16 April 98). The guidelines are being prepared to assist WARB in designing future impact assessment studies.

- Provide WARB with a copy of the 1998 Annual Progress Report to AFOSR entitled "Modeling the Fate of Military Aircraft Anti-De-icing Agents through Environmental Transport" by CU-B.
- Meet with Mike Bolton to discuss deicing operations at the Municipal Airport and their impact on WARB.

**People Contacted:**

Jack Moriarty – 439 SGPT/CEV (x-2434)

Gina Rossi – 439 SGPT/CEV (x-2484)

Joe DeMartino-439 SGPT/LGS (x- )

Susan Stell – HQ AFRES/CEVCM (DSN 497-1078)

Bob Rys – Airfield Manager (x-2944)

Mike Bolton – Civilian Airfield Manager (COMM 593-5543)

**Trip Overview:**

- Upon review of the operation documents for the glycol recovery system, it was determined that use of the recycling system is only possible with >50% PG waste streams. A waste stream of >50% PG could only be generated by deicing within the hangar or fuel cell. In lieu of using PG in these locations, the heating systems are typically employed. At other locations on site, 20-30% PG is typically used for deicing. As a result, we can eliminate the possibility of using the glycol recovery system at WARB as a means of on-site treatment of deicing waste.
- Two tanks with a combined capacity of 13,000 gallons are available for on-site storage of deicing waste. In the event that these tanks have reached capacity, CEV is responsible for implementing a method of ultimate disposal for the deicing waste.
- There is no new information regarding the status of WARB's NPDES permit according to Gina Rossi.
- RIDs system is still not repaired. The main difficulty in operation of the system is getting overtime help to arrive on-site before a deicing event to do anti-icing.

- Scheduled a meeting with Mike Bolton to review deicing practices at the Municipal Airport. He cancelled the meeting that afternoon. Jack Moriarty suggested writing a letter due to Mr. Bolton's unavailability to meet or speak on the phone.

### **SWP3 Meeting**

#### Deicing Procedures

#### Findings

- First priority for deicing is to park the C-5s in the pull-through hangar and fuel cell during a storm event to eliminate the need for deicing on the ramp. Last season, planes were tugged from the hangar or fuel cell and were able to fly without deicing.
- If planes are stored in the fuel cell, the tail must be deiced. If deicing fluid application is required, it is recommended that snow be plowed from under the tail before deicing operations to minimize clean-up requirements. LGS will coordinate this procedure with Grounds and Roads. The deicing sweeper truck will be used to collect any deicing waste.
- Problems arise if planes are being washed or are undergoing major maintenance in fuel cell or the hangar. According to Mike Majors (LGM), deicing is first priority in the pull-through. All scheduling conflicts should be avoided.
- Pad 0-5 is used approximately 70-75% of the time. In case of a change in wind direction, Pad 2-3 is used.
- LGS currently is responsible for training their own people including those responsible for deicing TA aircraft. All procedures followed are outlined in the "Supervisor's Handbook".
- It is necessary for all planes to undergo a pre-flight procedure that takes place 3 to 3.5 hours before take-off. Preflight is performed at E-8 or in the hangar or fuel cell.
- Any deicing operations at E-8 will include the use of gel mats to cover the storm drains and sweeper trucks to collect aircraft deicing waste.
- Flights are seldom cancelled. In the case of a storm event, crews will wait 4 or 5 hours until they are able to go. Cross-country and cross channel flights are given priority over local flights.

## Conclusion

All C-5 planes must undergo a pre-flight procedure that requires deicing. In the case of a continuing storm event, deicing will occur both at E-8 and at Pad 0-5 (or Pad 2-3).

Deicing at E-8 can be avoided if the planes are parked in the hangar or fuel-cell prior to pre-flight.

## Airfield Deicing

- Grounds and Roads at WARB currently relies on urea and plows for snow removal on runways. The short-term goal is to eliminate urea due to its high pollutant load. In lieu of urea, WARB is investigating use of potassium acetate as an alternative roadway deicer. WARB is currently investigating funding for acetate application equipment.
- Bob Rys from Grounds and Roads estimated that he would use 6,000 gallons of potassium acetate per application. He expressed the need for a 30,000-gallon storage tank and a liquid spreader truck.

## **Review of Submitted Draft Documents**

- Discussed the Draft of the Deicing Section of the SWP3 (Appendix A) with Jack Moriarty. He would prefer the chapter not be in checklist form as submitted. He would like the chapter to include detailed instructions on deicing practices in a worst case scenario including deicing at E-8 and Pad 0-5 as well as information regarding AF policy.
- The Literature Review of ADF Treatability (Appendix B) was reviewed. Jack Moriarty deemed the document acceptable.
- From the Literature Review, it is possible to eliminate engineered on-site treatment alternatives (i.e., aerobic/anaerobic treatment systems) for deicing waste at WARB. The majority of engineered systems require a continuous flow of waste for adequate treatment results. Other methods are untested to date. Passive treatment alternatives are a possibility at WARB including land treatment, which is currently being

employed at Albany County Airport and at several airports in Scandinavia. However, regulatory concerns must be addressed.

- At this juncture, technology does not exist to allow airbases to meet the AF policy which is an ultimate goal of zero discharge. However, CU-B recommends continued use of BMPs/PPPs at WARB to minimize the environmental impact of deicing practices.
- Jack Moriarty confirmed the need for a letter on file from the Wastewater Treatment Facility outlining an agreement regarding discharge of ADF waste to the facility per Air Force requirements. CU-B will provide a draft of this letter to WARB.
- Jack Moriarty will spend additional time reviewing the Draft of the Sampling Plan (Appendix C) submitted by CU-B and will provide his comments at a later date.

**Scope of work to be provided by CU-B:**

- Assist WARB in drafting a letter to the Chicopee Wastewater Treatment Facility regarding discharge of ADF waste collected in storage tanks.
- The Literature Review of Treatability of ADF Waste was submitted and accepted.
- CU-B will provide a chapter to be included in the SWP3 regarding deicing procedures to be carried out at WARB.
- CU-B will review the Groundwater Sampling Results from the Wetlands Assessment (dtd 16 April 98) and will provide guidance for the development of a sampling plan at Pads 23 and 05 to investigate the potential impact of deicing practices on those areas.
- All documents are to be completed by May 1999.
- Another site visit will be scheduled for April 1999 to review the documents with WARB prior to final submittal.
- CU-B will prepare an attachment to the Literature Review regarding the International Symposium entitled "Deicing and Dustbinding - Risk to Aquifers" held in Helsinki, Finland on October 14-16, 1998 (Appendix D).

**Some action items to be completed:**

- Draft a letter to the local POTW (POC: Gruden) for discharge of ADF waste.
- Details on Commercial Airline Operations at WARB (Mike Bolton 413-593-5543 POC: Gruden).
- Provide CU-B with comments regarding the Draft Sampling Plan Guidelines submitted (POC: Moriarty).
- Provide CU-B with Supervisor's Handbook from LGS (POC: Moriarty).
- Complete revisions to SWP3 chapter as recommended by Jack Moriarty (POC: Gruden).

## APPENDIX A



## ***Draft SWP3 Chapter***

### **Deicing Practices**

#### **439 SPTG/CEV Westover Air Reserve Base (WARB)**

##### **I. Guidance Documents:**

- a. USAF/CEV Interim Guidance dated 5 Dec 96 "Pollution Prevention and Best Management Practices for Aircraft and Airfield Deicing/Anti-icing Operations"
- b. AFRC/CEV letter dated 27 June 97 "Guidance Package for Anti-icing and Deicing of Planes, Aprons, and Runways"

##### **II. Description of Potential Deicing Locations:**

The following locations have been used for deicing: Pad 23, Pad 05, Pad 19, North Ramp, VIP, East Ramp at E-8, and the fuel cell for tail deicing. Deicing is preferably done at Pads 23 and 05. At Pad 23, deicing is done at the northeast side of the pad in order to avoid direct discharge to stormwater. Deicing at Pad 19 was a one-time occurrence due to a Special Operation that overwhelmed the parking capacity. Deicing at Pad 19 is not recommended. If deicing occurs at the East Ramp, the North Ramp, the VIP or the fuel cell, storm drains are covered with mats, and the deicing waste is collected with sweeper trucks and deposited in the dedicated underground storage tank located in the pull-through hangar.

##### **III. Deicing Procedures at WARB in accordance with Best Management Practices/Pollution Prevention Procedures in the USAF/CEV Interim Guidance (dtd 5 Dec 96).**

###### A. General Deicing Procedures and Responsible Parties.

###### 1. Training/Supervision

- a. All deicing practices are observed by **ORG/OFFICE SYMBOL TA**  
Also?



- b. The deicing fluid is mixed with water according to ambient air temperatures by **ORG/OFFICE SYMBOL**. The minimum amount of deicing fluid to be used is \_\_\_\_.

## 2. Data Collection/Record Keeping

- a. Logs are kept by drivers of the deicing trucks (**ORG/OFFICE SYMBOL**).
- b. A log should be developed by the responsible party and filed as an attachment to the SWP3.
- c. Logs include date, gallons of deicer used, gallons of water used, location of deicing, and airframe number.
- d. Logs of manpower requirements are also kept by **ORG/OFFICE SYMBOL**.

## 3. Roadway Ice Detection System (RIDs)

- a. Not currently in operation at WARB. It is scheduled to be repaired by **date (ORG/OFFICE SYMBOL)**.
- b. This system reduces the need to deice by alerting personnel of approaching freezing conditions.

## 4. Pavement Deicers

- a. WARB relies primarily on mechanical removal methods for pavement deicing. **sand? MgCl?**
- b. Occasionally, urea is used in isolated spots.
- c. Pavement deicing carried out by CE Roads and Grounds.

## 5. Aircraft Anti-icing

- a. Type II deicing fluid is not used at WARB.

#### *6. Containment of Deicers Prior to Reaching Waterways*

- a. When deicing occurs in the catchment area of a storm drain, the storm drain is sealed with a gel mat by **ORG/OFFICE SYMBOL**. Sweeper trucks (**ORG/OFFICE SYMBOL**) collect the accumulated deicing waste and discharge it the dedicated underground storage tank located in the pull-through hangar.

#### 7. Recycling

- a. The on-site recycling system is currently not in operation.
- b. Deicing waste generated at WARB is typically not concentrated enough (>50% PG) for recycling.
- c. Other recycling operations were considered for disposal of deicing waste in 97/98.

#### *8. Deicing Waste Disposal*

- a. In the event that the dedicated deicing storage tank becomes full, deicing waste should be diverted to **where** by **ORG/OFFICE SYMBOL**.
- b. Following a deicing event, deicing waste is taken from the dedicated storage tank and is sent **where or where?** (**ORG/OFFICE SYMBOL**).
- c. If deicing waste is to be diverted to a local wastewater treatment facility, a letter must be on file indicating the agreement that WARB has with the facility allowing this discharge.

#### B. Deicing Operations Specific to 439 Aircraft Generation Squadron (AGS): C-5s Only

##### 1. Mission Scheduling/Prioritization

- a. Non mission essential sorties may be cancelled or delayed during a deicing event.

- b. The Operations Group (**ORG/OFFICE SYMBOL**) determines mission prioritization based on existing weather conditions and forecasts.
- c. An attempt is made to reduce the flying schedule 10-15% during the deicing season.

## 2. Aircraft Parking

- a. C-5s are stored in the pull-through hangar or fuel cell if weather forecasts predict a deicing event.
- b. Aircraft stored in the pull-through must have tail deicing done.
- c. Aircraft not stored indoors are often deiced using the hangar heating system.
- d. Aircraft are oriented to take advantage of natural melting from the sun.

## 3. Mechanical Ice and Snow Removal

- a. Shovels and squeegees are used for ice and snow removal.
- b. A cherry picker is used for access to all parts of the aircraft for snow and ice removal.
- c. During a precipitation event, heating the aircraft surface is not recommended as it causes additional accumulation of snow and ice.
- d. All standard practices are observed by **ORG/OFFICE SYMBOL**.

## 4. Aircraft Washracks

- a. Snowmelt is diverted to the aircraft washracks when the hangar heating system is used for deicing. Snowmelt is then transferred to the underground storage tank located in the hangar.

## C. Deicing Operations Specific to Transient Alert (TA)

### 1. Mission Scheduling/Prioritization

- a. Sorties may be delayed during a deicing event.

- b. Wing Commander and Chief of Operations (**ORG/OFFICE SYMBOL**) determine mission scheduling during a deicing event.

## 2. Aircraft Parking

- a. All TA aircraft are parked on the North Ramp.
- b. TA C-5s are handled by AGS.
- c. Aircraft are parked in the sun to facilitate melting.

## 3. Mechanical Ice and Snow Removal

- a. Shovels and squeegees are used for ice and snow removal.
- b. A cherry picker is used for access to all parts of the aircraft for snow and ice removal.
- c. Additional manpower is provided by AGS.
- d. All standard practices are observed by **ORG/OFFICE SYMBOL**.

## **IV. V. Environmental Release of Aircraft Deicing Fluid.**

In the event of a release of aircraft deicing fluid to the a surface water, applicable regulators should be contacted by (**ORG/OFFICE SYMBOL**). **Who are the regulators?** In dry weather conditions, a release is considered a violation of permit. However in storm event conditions, a release to the environment is not considered in violation of the permit.

In any event, sampling will be required to determine the extent of impact on the receiving waters. Sampling should be begun within 24 hours of the release and should be continued periodically in accordance with regulatory requirements (**ORG/OFFICE SYMBOL**).

### **People Contacted to Outline These Procedures:**

Jack Moriarty – 439 SGPT/CEV (x-2434)  
Gina Rossi – 439 SGPT/CEV (x-2484)  
Michael Major - 439 AGS/LGG (x-2370)  
Alan Rogers 439- AGS/LGG (x-2877) DSN 589  
Capt. David Post - 439 AGS/LGG (x-3311)  
Daniel Carr – 439AGS/LGLS (Scheduling (LG)) (x-3042)  
Les Squire – 439 AGS/MAM (x-2158)  
Bob Rys – Airfield Manager (x-2944)

## APPENDIX C

## ***Draft Sampling Plan Guidelines:***

**Goal:** To determine the impact of deicing operations on areas adjacent to deicing pads.

### **Literature Review**

A literature review on the fate of deicing fluids should be completed. This review should include data collected for any RCRA or CERCLA sites at WARB for site characterization information. Also, the research should involve airbases or airports that have similar environmental conditions and concerns. This information should be helpful in determining strategies for a study at WARB. (JSC will contact AFCEE to collect information on the remediation efforts at Scott AFB in St. Louis and Grisom AFB in Syracuse where EG-based deicing fluid spills were incurred).

### **Identification of Potentially Impacted Environments**

**Groundwater.** A certified professional should be hired to determine the hydrogeology of the proposed site. The hydrogeologic study should provide the hydraulic properties of the subsurface. These properties are used to estimate flow direction and velocity. Also, subsurface flow direction and velocity are often calculated through conservative tracer studies (i.e., bromide, chloride, rhodamine dye). This information is necessary for determining monitoring well placement and sampling frequency.

A geoprobe survey or hydropunch may be used to clearly identify the subsurface locations within the flow path of the deicing waste. The hydropunch takes samples at variable depth and location without the use of a drill. This method is more expensive than the previously proposed methods, however the results are unambiguous.

**Surface Water.** Overland flow patterns should be calculated during storm events and dry weather events. The surface waters that will intercept the overland flow should be identified. The flow direction and velocity in the surface water need to be estimated for proper sampling locations and adequate sample frequency. Conservative tracer studies can also be used for this purpose.

The Stormwater Pollution Prevention Plan should be reviewed to evaluate the potential introduction of deicing waste into the stormwater system. If deicing operations occur in the catchment area of a storm drain, the connections and the receiving body of water should be determined. The approximate travel time required to reach the receiving water should be noted. This can be calculated using a peanut test or dye tracer test.

**Soil.** The characterization of the soil should be completed as part of the hydrogeologic study. This information may also be found if there are existing RCRA or CERCLA sites at WARB. This data collected should include a table of parameters to be provided by CU-Boulder that can be used to evaluate the potential of that location for natural attenuation.

### **Sampling Location and Frequency.**

**Groundwater.** Two monitoring wells should be located in “control” areas that will not be impacted by deicing operations. These wells will be used for identifying background levels. A series of several monitoring wells should be installed in the potential flow path of the plume as defined by the hydrogeologic study. An array of three wells (minimum) should be located perpendicular to groundwater flow within 5 to 10 feet of the point of discharge. At least two more arrays of monitoring wells should be installed. The furthest set should be located adjacent to the boundary defining the area of interest. The second set should be installed 1/3 the total distance from the discharge point.

**Surface Water.** Two locations should be identified as surface water “control” samples for establishing background levels. Surface water samples should be grab samples performed in triplicate at the same approximate depth along the proposed flow path. Sediment samples may also need to be taken depending upon the analyte of interest. Some analytes will concentrate in the organic matter in the sediment.

**Sampling.** Samples should be taken at the nearfield wells and in the receiving surface waters within 24 hours of deicing operations. Sampling should continue periodically until all levels return to background levels as measured in the control wells. Samples may be analyzed for PG using a Hach kit or the New York State Department of Environment’s accepted chemical method. Analysis of MEBT is more difficult, but the sampling procedure is easier and biodegradation in stored samples is unlikely to occur.

## ***Draft Sampling Plan Guidelines:***

**Goal:** To determine the impact of deicing operations on areas adjacent to deicing pads.

### **I. Literature Review**

A literature review on the fate of deicing fluids should be completed. This review should include data collected for any RCRA or CERCLA sites at WARB for site characterization information. Also, the research should involve airbases or airports that have similar environmental conditions and concerns. This information should be helpful in determining strategies for a study at WARB. (JSC will contact AFCEE to collect information on the remediation efforts at Scott AFB in St. Louis and Grissom AFB in Syracuse where EG-based deicing fluid spills were incurred).

### **II. Identification of Potentially Impacted Environments**

**Groundwater.** A certified professional should be hired to determine the hydrogeology of the proposed site. The hydrogeologic study should provide the hydraulic properties of the subsurface. These properties are used to estimate flow direction and velocity. Also, subsurface flow direction and velocity are often calculated through conservative tracer studies (i.e., bromide, chloride, rhodamine dye). This information is necessary for determining monitoring well placement and sampling frequency.

A geoprobe survey or hydropunch may be used to clearly identify the subsurface locations within the flow path of the deicing waste. The hydropunch takes samples at variable depth and location without the use of a drill. This method is more expensive than the previously proposed methods, however the results are unambiguous.

**Surface Water.** Overland flow patterns should be calculated during storm events and dry weather events. The surface waters that will intercept the overland flow should be identified. The flow direction and velocity in the surface water need to be estimated for proper sampling locations and adequate sample frequency. Conservative tracer studies can also be used for this purpose.



The Stormwater Pollution Prevention Plan should be reviewed to evaluate the potential introduction of deicing waste into the stormwater system. If deicing operations occur in the catchment area of a storm drain, the connections and the receiving body of water should be determined. The approximate travel time required to reach the receiving water should be noted. This can be calculated using a peanut test or dye tracer test.

**Soil.** The characterization of the soil should be completed as part of the hydrogeologic study. This information may also be found if there are existing RCRA or CERCLA sites at WARB. This data collected should include a table of parameters to be provided by CU-Boulder that can be used to evaluate the potential of that location for natural attenuation.

### **III. Sampling Location and Frequency.**

**Groundwater.** Two monitoring wells should be located in "control" areas that will not be impacted by deicing operations. These wells will be used for identifying background levels. A series of several monitoring wells should be installed in the potential flow path of the plume as defined by the hydrogeologic study. An array of three wells (minimum) should be located perpendicular to groundwater flow within 5 to 10 feet of the point of discharge. At least two more arrays of monitoring wells should be installed. The furthest set should be located adjacent to the boundary defining the area of interest. The second set should be installed  $1/3$  the total distance from the discharge point.

**Surface Water.** Two locations should be identified as surface water "control" samples for establishing background levels. Surface water samples should be grab samples performed in triplicate at the same approximate depth along the proposed flow path. Sediment samples may also need to be taken depending upon the analyte of interest. Some analytes will concentrate in the organic matter in the sediment.

**Sampling.** Samples should be taken at the nearfield wells and in the receiving surface waters within 24 hours of deicing operations. Sampling should continue periodically until all levels return to background levels as measured in the control wells. Samples may be analyzed for PG using a Hach kit or the New York State Department of Environment's accepted chemical method. Analysis of MEBT is more difficult, but the sampling procedure is easier and biodegradation in stored samples is unlikely to occur.



## ***Draft SWP3 Chapter***

### **Deicing Practices**

#### **439 SPTG/CEV Westover Air Reserve Base (WARB)**

#### **I. Guidance Documents:**

- a. USAF/CEV Interim Guidance dated 5 Dec 96 "Pollution Prevention and Best Management Practices for Aircraft and Airfield Deicing/Anti-icing Operations"
- b. AFRC/CEV letter dated 27 June 97 "Guidance Package for Anti-icing and Deicing of Planes, Aprons, and Runways"

#### **II. Description of Potential Deicing Locations:**

The following locations have been used for deicing: Pad 23, Pad 05, Pad 19, North Ramp, VIP, East Ramp at E-8, and the fuel cell for tail deicing. Deicing is preferably done at Pads 23 and 05. At Pad 23, deicing is done at the northeast side of the pad in order to avoid direct discharge to stormwater. Deicing at Pad 19 was a one-time occurrence due to a Special Operation that overwhelmed the parking capacity. Deicing at Pad 19 is not recommended. If deicing occurs at the East Ramp, the North Ramp, the VIP or the fuel cell, storm drains are covered with mats, and the deicing waste is collected with sweeper trucks and deposited in the dedicated underground storage tank located in the pull-through hangar.

#### **III. Deicing Procedures at WARB in accordance with Best Management Practices/Pollution Prevention Procedures in the USAF/CEV Interim Guidance (dtd 5 Dec 96).**

##### A. General Deicing Procedures and Responsible Parties.

##### *1. Training/Supervision*

- a. All deicing practices are observed by **ORG/OFFICE SYMBOL TA**  
Also?

- b. The deicing fluid is mixed with water according to ambient air temperatures by **ORG/OFFICE SYMBOL**. The minimum amount of deicing fluid to be used is \_\_\_\_.

## *2. Data Collection/Record Keeping*

- a. Logs are kept by drivers of the deicing trucks (**ORG/OFFICE SYMBOL**).
- b. A log should be developed by the responsible party and filed as an attachment to the SWP3.
- c. Logs include date, gallons of deicer used, gallons of water used, location of deicing, and airframe number.
- d. Logs of manpower requirements are also kept by **ORG/OFFICE SYMBOL**.

## *3. Roadway Ice Detection System (RIDs)*

- a. Not currently in operation at WARB. It is scheduled to be repaired by **date (ORG/OFFICE SYMBOL)**.
- b. This system reduces the need to deice by alerting personnel of approaching freezing conditions.

## *4. Pavement Deicers*

- a. WARB relies primarily on mechanical removal methods for pavement deicing. **sand? MgCl?**
- b. Occasionally, urea is used in isolated spots.
- c. Pavement deicing carried out by CE Roads and Grounds.

## *5. Aircraft Anti-icing*

- a. Type II deicing fluid is not used at WARB.

6. *Containment of Deicers Prior to Reaching Waterways*

- a. When deicing occurs in the catchment area of a storm drain, the storm drain is sealed with a gel mat by **ORG/OFFICE SYMBOL**. Sweeper trucks (**ORG/OFFICE SYMBOL**) collect the accumulated deicing waste and discharge it the dedicated underground storage tank located in the pull-through hangar.

7. *Recycling*

- a. The on-site recycling system is currently not in operation.
- b. Deicing waste generated at WARB is typically not concentrated enough (>50% PG) for recycling.
- c. Other recycling operations were considered for disposal of deicing waste in 97/98.

8. *Deicing Waste Disposal*

- a. In the event that the dedicated deicing storage tank becomes full, deicing waste should be diverted to **where** by **ORG/OFFICE SYMBOL**.
- b. Following a deicing event, deicing waste is taken from the dedicated storage tank and is sent **where or where?** (**ORG/OFFICE SYMBOL**).
- c. If deicing waste is to be diverted to a local wastewater treatment facility, a letter must be on file indicating the agreement that WARB has with the facility allowing this discharge.

B. Deicing Operations Specific to 439 Aircraft Generation Squadron (AGS): C-5s Only

1. *Mission Scheduling/Prioritization*

- a. Non mission essential sorties may be cancelled or delayed during a deicing event.

- b. The Operations Group (**ORG/OFFICE SYMBOL**) determines mission prioritization based on existing weather conditions and forecasts.
- c. An attempt is made to reduce the flying schedule 10-15% during the deicing season.

## *2. Aircraft Parking*

- a. C-5s are stored in the pull-through hangar or fuel cell if weather forecasts predict a deicing event.
- b. Aircraft stored in the pull-through must have tail deicing done.
- c. Aircraft not stored indoors are often deiced using the hangar heating system.
- d. Aircraft are oriented to take advantage of natural melting from the sun.

## *3. Mechanical Ice and Snow Removal*

- a. Shovels and squeegees are used for ice and snow removal.
- b. A cherry picker is used for access to all parts of the aircraft for snow and ice removal.
- c. During a precipitation event, heating the aircraft surface is not recommended as it causes additional accumulation of snow and ice.
- d. All standard practices are observed by **ORG/OFFICE SYMBOL**.

## *4. Aircraft Washracks*

- a. Snowmelt is diverted to the aircraft washracks when the hangar heating system is used for deicing. Snowmelt is then transferred to the underground storage tank located in the hangar.

## C. Deicing Operations Specific to Transient Alert (TA)

### *1. Mission Scheduling/Prioritization*

- a. Sorties may be delayed during a deicing event.

- b. Wing Commander and Chief of Operations (**ORG/OFFICE SYMBOL**) determine mission scheduling during a deicing event.

## *2. Aircraft Parking*

- a. All TA aircraft are parked on the North Ramp.
- b. TA C-5s are handled by AGS.
- c. Aircraft are parked in the sun to facilitate melting.

## *3. Mechanical Ice and Snow Removal*

- a. Shovels and squeegees are used for ice and snow removal.
- b. A cherry picker is used for access to all parts of the aircraft for snow and ice removal.
- c. Additional manpower is provided by AGS.
- d. All standard practices are observed by **ORG/OFFICE SYMBOL**.

## **V. Environmental Release of Aircraft Deicing Fluid.**

In the event of a release of aircraft deicing fluid to the a surface water, applicable regulators should be contacted by (**ORG/OFFICE SYMBOL**). **Who are the regulators?** In dry weather conditions, a release is considered a violation of permit. However in storm event conditions, a release to the environment is not considered in violation of the permit.

In any event, sampling will be required to determine the extent of impact on the receiving waters. Sampling should be begun within 24 hours of the release and should be continued periodically in accordance with regulatory requirements (**ORG/OFFICE SYMBOL**).

### **People Contacted to Outline These Procedures:**

Jack Moriarty – 439 SGPT/CEV (x-2434)  
Gina Rossi – 439 SGPT/CEV (x-2484)  
Michael Major - 439 AGS/LGG (x-2370)  
Alan Rogers 439- AGS/LGG (x-2877) DSN 589  
Capt. David Post - 439 AGS/LGG (x-3311)  
Daniel Carr – 439AGS/LGLS (Scheduling (LG)) (x-3042)  
Les Squire – 439 AGS/MAM (x-2158)  
Bob Rys – Airfield Manager (x-2944)